

Investigation of the $^{40}\text{K}/\text{K}$ Ratio in a Loomis, MI Sediment Profile and Various Cherts with Prompt Gamma-Ray Activation Analysis (PGAA)

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Paleo-Indian occupation of North America is conventionally assumed to have occurred at about 12,000 yr B.P. A common problem in the analysis of Paleo-Indian archaeological sites near the Great Lakes is the recovery of especially young radiocarbon dates ranging from 160-3380 yr B.P. These dates conflict with thermoluminescence results suggesting a $\approx 12,000$ yr B.P. date. Chert artifacts from these sites revealed a high density of ≈ 100 μm diameter entrance wounds and embedded particles, preferentially found on only one side of the artifact. A large concentration of micrometeorite-like material was also found in adjacent sediments.

It was proposed¹ that a nearby cosmic event like a supernova irradiated the landscape near the end of the ice age base on evidence of substantial neutron irradiation of the landscape depleting ^{235}U and producing excess ^{239}Pu . The reported neutron fluxes were also sufficient to convert measurable amounts of ^{39}K to ^{40}K . We have analyzed a sediment profile from Loomis, MI with Prompt Gamma-Ray Activation Analysis (PGAA) at the Budapest Reactor. Samples were taken at 5 cm intervals from the A-, B-, and C-horizons to depths where the artifacts originated. ^{40}K was analyzed by γ -ray counting at the LBNL Low-Background Counting Facility, and ^{39}K by PGAA. The resulting $^{40}\text{K}/\text{K}$ is shown in Figure 1 where No anomalous ^{40}K abundance is observed. Thermal Ionization Mass Spectroscopy (TIMS) measurements of $^{235}\text{U}/^{238}\text{U}$ ratios in related cherts, reported elsewhere, also failed to confirm the anomalies.

The analysis $^{40}\text{K}/\text{K}$ by PGAA and γ -ray counting in samples of bedrock chert is shown in Table 1. Bayport and Upper Mercer cherts were utilized by Paleo-Indians and show elevated ^{40}K abundance. Fossil Hill and Onondaga cherts with no Paleo-Indian association yielded normal ratios. These results suggest that cherts associated with

the Paleo-Indian occupation of the North America may have been exposed to substantial neutron irradiation following a nearby supernova. However, only the chert, not the associated sediments, was affected suggesting it may have been irradiated much earlier before the Paleo-Indians gathered it.

The Loomis sediment profile was analyzed for many other elements, including H, B, Na, Al, Si, Cl, Ca, Mn, Fe, Cu, Sm, Gd, Th, and U, by PGAA and γ -ray counting. These results will be presented in future reports.

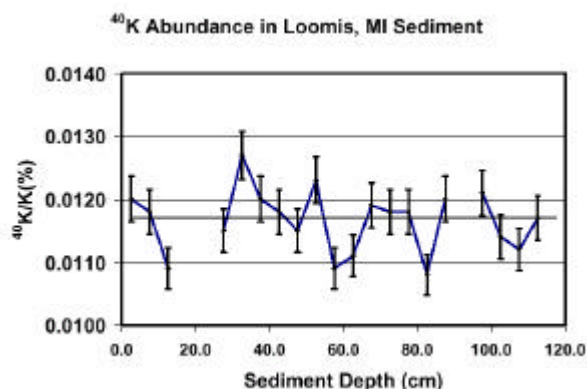


Figure 1. ^{40}K abundance in Loomis, MI sediment. The solid line indicates the expected abundance ($0.0117 \pm 0.0001\%$) for ^{40}K in nature.

Table 1. ^{40}K abundance in bedrock chert.

Chert	$^{39}\text{K}/\text{K}(\%)$
Bayport	0.018 ± 0.003
Fossil Hill	0.010 ± 0.002
Onondaga	0.0111 ± 0.009
Upper Mercer	0.022 ± 0.007

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¹ Mammoth Trumpet, 16, 7 (2001)